REMARKS

A. Claim Rejections - 35 U.S.C. § 103

1. Status of claims

Claims 1-22 have been rejected under 35 U.S.C. § 103(a) over U.S. Patent No. 5,436,097 to Norishima in view of U.S. Patent No. 6,589,699 to Kaneko. Claims 1, 2, 4 and 15 have been amended to more clearly recite that which the Applicants regard as the invention.

2. Introduction

The claims are patentable since the references do not teach or reasonably suggest a photomask having radiation shielding structures formed over a continuous sacrificial conductive layer that dissipates charge during testing of the photomask itself. Rather, the references disclose conventional photomasks that lack a continuous sacrificial conductive layer as claimed. In addition, the primary reference explicitly teaches away from certain aspects of the invention.

3. Overview of Claimed Subject Matter

Applicants found that when testing the quality of a photomask to determine if the mask meets standards for use in lithographic processes, the measurement tool could charge regions of the mask (page 1, line 23 to page 2, line 7). The charging of the mask diminishes the accuracy of tests conducted. The problem is of particular concern when making critical dimension (CD) measurements of radiation shielding structures of the mask with an electron microscope.

To improve the accuracy of testing the radiation shielding structures formed on the mask, the Applicants invented a new and unobvious mask structure and method of manufacture. The invented mask structure includes a continuous conductive layer under the radiation shielding structures. The continuous conductive layer provides a conductive backplane to the structures such that charge transferred from the

measurement tool to the mask during testing of the structures can be dissipated, thereby improving the accuracy of the test measurements.

While many conventional photomasks use conductive material for the radiation shielding layer, that material is patterned along with any associated layers (e.g., an ARC and/or a BARC) such that many of the resulting structures are electrically isolated from other structures. In the conventional masks arrangements, any charge transferred to the isolated structures during testing has no dissipation path and disrupts the test. Therefore, the invention marks a novel and unobvious advancement in the art.

4. Deficiencies in the Applied Art

Even if one were to combine the references in the proposed manner, the claimed invention would not result. Missing from the combination would be a continuous conductive layer disposed under radiation shielding structures that dissipates charge while conducting measurements of the structures.

With reference to Norishima, Norishima is directed to evaluating an aligner tool by forming a wafer with a mask that has a particular pattern. The particular mask pattern, when transferred to the wafer results in wafer structures that have resistance values indicative of aligner performance and the wafer structures collectively form a calibration pattern.

More importantly, the mask of Norishima is a conventional mask with radiation shielding structures to impart the desired calibration pattern on the wafer and does not have a continuous conductive layer under the radiation shielding structures. The summary section of Norishima at column 2, line 45 to column 3, line 20 provides a clear overview to the disclosure of Norishima. After reading this section along with the detailed description section (particularly, column 4, lines 23-27 that describes the mask used and column 7 lines 36-61 that describes the aligner evaluation technique), it is apparent that Norishima has no disclosure of the claimed continuous conductive layer.

Also apparent is that Norishima contains no disclosure conducting measuring parameters of the mask structures. Rather, the measurements are made of the resulting wafer structures.

The Examiner asserts that Norishima teaches a mask with "a sacrificial conductive layer" and that "during the measuring the sacrificial conductive layer provides a conductive plane to dissipate charge transferred to the mask by the measurement tool." However, the Examiner does not support these conclusions with citations to particular sections of Norishima. It is suspected that the Examiner is referring to the wafer pattern and measurements thereof. Of course, the wafer structures are not mask structures and cannot serve to teach a conductive layer that dissipates charge while evaluating radiation shielding structures of the photomask. In this regard, Norishima teaches away from aspects of the claimed invention. For example, Norishima uses a mechanical probe to measure resistance of the wafer structures, which are formed on an insulating layer (oxide film 52). Even if one were to make an unmotivated modification to Norishima and include a continuous conductive layer under the structures of the wafer, the measurements of Norishima could not be made because the conductive layer would short structures together and lead to changes in the effective resistance of the structures measured. Therefore, Norishima cannot be considered to include the claimed conductive layer as the conductive layer would interfere with the desired measurements.

The Examiner combines the teachings of Norishima with Kaneko due to a lack of disclosure of a chromium containing layer in Norishima's mask. While Kaneko certainly teaches various chromium containing layers for a photomask, this is not a feature that is recited in the claims of the application other than in dependent claims 5 and 18. In addition, Norishima teaches the use of chromium (col. 4, line 25) in his mask. Therefore, there is no need to combine the references other than to supplement the teaching of Norishima with a particular chromium containing compound. As such, there is no reason or desire to combine the references and motivation is lacking to combine the references, especially with respect to claims 1-4, 6-17 and 19-22.

Even more importantly, Kaneko fails to cure the deficiencies of Norishima. While Kaneko discloses forming radiation shielding structures from plural layers (a light-shielding film and an antireflecting film or films), each of those layers are patterned in stacks to collectively form radiation shielding structures. Kaneko fails to teach or reasonably suggest a continuous conductive layer present under the structures. Therefore, even if one were to combine the references in the proposed manner, the claimed invention would not result.

For at least these reasons, independent claims 1 and 15 are patentable over the proposed combination. Claims 2-14 depend from claim 1 and claims 16-22 depend from claim 15. Accordingly, the dependent claims are also allowable for at least the reasons set forth above. Also, the dependent claims recite additional novel and unobvious features of the invention.

For example, claim 2 recites that once the measurements are taken of the radiation shielding structures, the pattern of those structures is transferred to the conductive layer. In this manner, the mask can be used in the lithographic processing of wafers with minimal interference from the conductive layer. The references contain no teaching or suggestion of the features of claim 2.

Claims 3-4 and 16-17 are directed to etch selectivity between the radiation shielding layer and the conductive layer. Claim 4 also recites features similar to those of claim 2. The references contain no teaching or suggestion of the features of these claims.

Claims 6 and 15 recite materials that can be used in the photomask's continuous conductive layer. The references contain no teaching or suggestion of the features of claims 6 and 15.

Claims 7 and 20 recites that the measurement tool used to evaluate the radiation shielding structures is an electron microscope. Norishima explicitly teaches away from using an electron microscope as a measurement tool since an electron microscope would compromise throughput in his system (column 2, lines 24-40 and column 6, lines

40-43) and makes certain measurements "substantially impossible" (column 9, lines 12-18). Instead, Norishima uses a probe.

Claim 8 recites rejecting the mask if the measured parameters of the radiation shielding structures fall outside acceptable tolerances. The references do not teach or suggest acceptance testing of a photomask.

Claim 9 recites that the measured parameter is critical dimension (CD) of the radiation shielding layer structures. The references do not teach or suggest measuring this parameter.

Claims 10, 11 and 21 recite relative placement of the conductive layer with respect to the radiation shielding layer. Since the references do not teach or suggest a conductive layer, the references contain no teaching or suggestion of the features of claims 10, 11 and 21.

Claims 12 and 22 recite that the relative positioning of the conductive layer and the radiation shielding structures allows for proxy testing of other radiation shielding structures. The references contain no teaching or suggestion of the features of claims 12 and 22.

Claim 13 and 14 are directed to connecting the conductive layer to a potential. The references contain no teaching or suggestion of the features of claims 13 and 14.

5. Patentability of the Claims

As can be appreciated from the above, the claims recite patentable subject matter. Accordingly, reconsideration and withdrawal of the rejections under 35 U.S.C. 103(a) is respectfully requested.

B. Conclusion

In light of the foregoing, it is respectfully submitted that the present application is in condition for allowance and notice to that effect is hereby requested. If it is determined that the application is not in condition for allowance, the Examiner is invited

to initiate a telephone interview with the undersigned representative to expedite prosecution of the present application.

If there are any additional fees resulting from this communication, please charge same to our Deposit Account No. 18-0988, our Order No. H1695.

Respectfully submitted,

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